行政院所屬各機關因公出國人員出國報告書
出國報告（出國類別：參訪）

赴英國進行錐管玻璃及冷媒回收處理技術相關管理制度參訪

服務機關：行政院環境保護署
姓名職稱：劉　倩 助理環境技術師
派赴國家：英國
出國期間：103 年 10 月 3 日至 10 月 12 日
報告日期：103 年 12 月 30 日

摘要

廢棄物減量回收、資源的永續再利用為現代科技日新月異的熱門話題之一，由於台灣地狹人稠、腹地狹小，再加上天然資源的取得不亦，惟有將廢棄物妥為處理再利用才能有效減緩環境的負荷，由於我國目前陰極射線管(Cathode ray tube, CRT)電視機拆解後之廢棄錐管玻璃有去化管道不足，廢棄後電冰箱內的環保冷媒在處理過程中因閃火點溫度低有易爆炸之公安問題，為提升我國廢電子電器及廢資訊物品回收及處理效能，於 103 年 10 月 3 日至 12 日赴英國進行錐管玻璃及冷媒回收管道、處理技術、污染防治技術與再生料市場參訪，冀能藉由實地瞭解英國廢電子電機等物品類產品回收指令的推動經驗及成效、回收再利用設備發展現況，提供未來管理制度之參考。

本次除拜會英國環境、食品及鄉村事務部（Department for Environment, Food & Rural Affairs, DEFRA）、英國廢棄物及資源行動計畫辦公室（Waste & Resources Action Programme, WRAP）屬政府單位及研究機構外，亦針對實際進行回收集處理之回收聯盟司英國倫敦再利用聯盟（London Reuse Network）、處理機構 Nulife Glass 公司 Viridor Limited 公司及 Environcom England Ltd 公司進行參訪。

此次藉由拜會 Nulife Glass 公司瞭解其利用高溫熔煉技術，可將陰極射線管（Cathode ray tube, CRT）電視廢棄後產生的廢錐管玻璃內鉛與玻璃完全分離，藉由有害物質回收（去除）比率，大幅提升了廢棄物再生料的品質與價值；在廢電冰箱處理技術部分，英國處理設備多採用可連續式作業之橫流壓混機進行處理，除利用鏈條撞擊產生的機械力將廢電冰箱各類物料進行分離外，在處理過程中全程皆利用注入氮氣防止因破碎過程引發爆炸，在處理設備上方亦設置排氣防爆洩壓通道，因此，英國處理廢電冰箱時可不需考慮冷媒種類，雖我國亦有處理廠具有恆流壓混機，惟設計不同造成冷媒收集效益不佳，未來仍應多蒐集各先進國家之處理規範以利我國制定相關管理政策。

另在英國在廢棄物管制上皆採取從源頭減量、延長使用年限方式辦理，對

於可再使用之電子電器設備也多採用「維修後再使用」方式，維修及再銷售之產品也都需經過該國 PAS-141 標準驗證，除保障民眾購買之品質外，亦讓此物品達到最佳的效益，減緩廢棄物產生的數量及時間；若遇無法再使用之廢棄物則由製造輸入業者負起環境影響代價之責任，繳交一定費用給予英國國內回收組織，由其作為後端回收業者、地方政府、處理業者之補貼費用，並由回收組織自行委託特定機關進行處理量監督，採自主管理而政府不介入。

目錄

壹、目的

科技技術的日新月異，全球的資訊電子產品都朝向著輕、薄設計，造成傳統的陰極射線管電視機大量被淘汰，現行我國多採用玻璃原料再利用之處理方式，惟其有害物質仍存在於玻璃中，若採用固化或焚化方式作為最終處置方式絕非長久之計；另早期冷凍空調設備裡所填充的冷媒因被發現會破壞臭氧層，故在民國 100 年我國家用的電冰箱及冷暖氣機就全面改用零臭氧消耗潛能（Ozone depletion potential ,ODP）、可接受的全球暖化潛能（Global warming potential ,GWP）及高性能係數（Coefficient of performance ,COP）之環保冷媒，雖然環保冷媒對臭氧層的破壞力較早期的傳統冷媒低，惟因為其閃火點溫度低，於回收處理時易有造成爆炸的工安危險。綜上，為尋找更多妥善處理廢陰極射線管電視機及環保冷媒回收清除處理管道、處理技術、污染防治技術與再生料市場，期望藉由英國參訪實地了解英國回電子電機等物品類產品回收指令的推動經驗及成效，並蒐集英國廢電子電器及資訊物品處理及再利用設備發展現況、實地確認回收再利用過程，藉以作為我國業者參酌。

貳、參訪行程

本次參訪行程為 103 年 10 月 3 日自桃園機場出發，10 月 12 日返抵台灣桃園機場，共計 10 日，正式參訪期間自 103 年 10 月 5 日至 10 月 10 日，出國行程與內容概要如表一所述：。

表 1　參訪行程表

日 期	工 作 內 容 概 要
103.10.03(五)	啟程至英國倫敦。
103.10.04(六)	資料準備與整理。
103.10.05(日)	資料準備與整理。 進行倫敦市區公共區域資源垃圾分類系統了解。倫敦市區街道垃圾及家戶垃圾收送係以委外民間公司執行處理，在垃圾袋部分有分多種顏色，係由各不同委外公司進行自行印製發送垃圾袋及僅回收印有該公司名稱垃圾袋所裝之垃圾，另政府有其專屬垃圾袋，家戶不可使用。
103.10.06(一)	拜會**環境、食品及鄉村事務部(Department for Environment, Food & Rural Affairs, DEFRA)及英國環境署(Environment Agency, EA)、英國商業發展技術部(Department for Business, Innovation & Skills, BIS)相關負責廢棄電子電機設備指令（Waste Electrical and Electronic Equipment Directive,WEEE）之官員**，瞭解英國廢電子電機設備回收管理體系執行現況，並以問答方式進行經驗交流討論，全程由我國駐英代表處陪同進行。
103.10.07(二)	參訪**處理廠Viridor Limited**，公司位於St. Helens的WEEE處理廠，回收處理項目包括廢電冰箱、廢電視、小型廢電子電器（如手機、耳機、喇叭）等廢物品。由該廠設備廠商德國ANDRITZ MeWa GmbH公司進行廢電冰箱、廢電子電機處理設備簡介說明後，由廠方人員帶領實際參觀廢電冰箱、廢電視及小型廢電子電器處理線。
103.10.08(三)	參訪**處理廠Environcom England Ltd.**，公司成立於西元2003年，為英國最大的廢電子電機設備再利用及精通回收廢電子電機設備之獨立公司，廠內回收之廢物品以白色家電為主，包括廢電冰箱、廢洗衣機、廢電爐等廢物品。由廠方代表先進行該公司廢物品處理體系介紹，其所有廢物品進場時皆以條碼進行管控，以利進行廢物品維修販售或破壞處理之篩選，並實際參觀廠內廢物品二手維修過程及廢電冰箱處理過程及其冷媒回收方式參觀。
103.10.09(四)	參訪**倫敦再利用聯盟London Reuse Network**，倫敦再利用聯盟協助社區及民眾將廢物品進行減量、再利用、循環再

日 期	工 作 內 容 概 要
	生，聯盟包含業者多達30幾家，包括廢物品二手販賣商店及維修廢物品業者。瞭解廢物品來源管道、二手商品維修流程外，亦至二手商品販售店面進行銷售方式瞭解。此行程由我國駐英代表處陪同進行。 拜會**Nulife Glass公司**了解錐管玻璃處理技術流程，Nulife Glass公司透過自行研發的高溫電熔爐，可將陰極射線管(Cathode ray tube, CRT)螢幕處理後產生之錐管玻璃經過粉碎清洗後，透過高溫熔爐將玻璃進行熔煉、分離後得到純度99.7%的鉛金屬和不含鉛的玻璃，且無鉛蒸氣逸散的問題。
103.10.10(五)	拜訪**廢棄物及資源行動計畫辦公室(Waste & Resources Action Programme, WRAP)**，WRAP成立於西元2000年，由環境、食品及鄉村事務部(Department for Environment, Food & Rural Affairs, DEFRA)、蘇格蘭政府、威爾斯政府所成立之一間非營利性公司，成立宗旨即是為了減少廢棄物之產生並提升廢棄物之回收量，達成經濟及環境效益，所扮演之角色如同介於政府單位、產業及財務部門之顧問單位。由該代表以簡報方式進行該單位業務、目前進行中之計畫（因應液晶顯示器背光源燈管市場轉變，進行發光二極體(Light-Emitting Diode,LED)回收研究）及歐盟非含汞標章介紹。
103.10.11(六)	下午赴倫敦希斯洛機場返回臺灣。

叁、參訪單位

本次參訪單位包括實地至英國環境、食品及鄉村事務部（Department for Environment, Food & Rural Affairs, DEFRA）、Viridor Limited 公司、Environcom England Ltd 公司、英國倫敦再利用聯盟（London Reuse Network）進行參訪，並與英國廢棄物及資源行動計畫辦公室（Waste & Resources Action Programme, WRAP）及 Nulife Glass 公司代表進行會談討論。

表 2　參訪單位一覽表

類別	參訪單位
政府單位	英國環境、食品及鄉村事務部（Department for Environment, Food & Rural Affairs, DEFRA）
研究機構	廢棄物及資源行動計畫辦公室（Waste & Resources Action Programme, WRAP）
回收聯盟	英國倫敦再利用聯盟（London Reuse Network）
處理機構	Viridor Limited（了解冰箱處理過程冷媒回收方式及填充碳氫環保冷媒回收及後續處理方式） Environcom England Ltd（了解冰箱處理過程冷媒回收方式及填充碳氫環保冷媒回收及後續處理方式） Nulife Glass（了解錐管玻璃高溫熔爐處理技術）

肆、參訪內容

一、 拜會英國環境、食品及鄉村事務部（Department for Environment, Food & Rural Affairs, DEFRA）

英國對於 WEEE 的管理係由不同單位各司其職進行管理，本次雖僅聯繫英國環境、食品及鄉村事務部（Department for Environment, Food & Rural Affairs, DEFRA），但連同英國環境署（Environment Agency, EA）、英國商業發展技術部（Department for Business, Innovation & Skills, BIS）亦受 DEFRA 邀請一同派員出席進行會談。

英國回收體系可分為生產者回收體制與地方政府及社區回收體制，生產者回收體制主要負責家電購買地點回收工作，在連鎖超商、量販店、家電業者…等販賣場所，消費者均可於購買新的家電產品的同時，將舊的家電產品交給販賣業者回收處理或轉交給再利用業者，而地方政府及社區回收體制則是依照民眾的需求，於特定地點設立回收站或是撥電話通知地方政府派人回收舊家電，之後再轉交給再利用業者。

針對錐管玻璃處理部分，目前英國並未禁止採用掩埋方式處理，雖英國境內有 Nulife 及 SWEEEP 兩家公司採用高溫電熔爐進行玻璃與鉛

金屬之分離處理方式，但由於英國電視訊號將由類比訊號全面升級爲數位訊號，CRT 電視市占率驟降，造成英國錐管玻璃回收量已呈現逐年下滑之趨勢，目前 WEEE 處理廠大多將錐管玻璃送交德國處理。

而冷媒回收技術標準規範部分，境內之 WEEE 處理業者採用之方法乃於密閉空間破碎冰箱箱體時注入液態氮降低處理過程中的爆炸風險，而冷媒經冷凝回收後便直接交由焚化處理，並未將回收冷媒純化後再利用，其主因在於烷類冷媒回收價值偏低，並不具經濟效益。

圖 1　與英國環境、食品及鄉村事務部 Ian Atkinson、英國環境署 Alan Owers、英國商業發展技術部 Graeme Vickery、駐英代表處郭克嚴合影

二、 參訪 Viridor Limited 處理廠

Viridor Limited 處理廠主要處理之 WEEE 種類包括冰箱、電視、小型電子電器（如手機、耳機、喇叭），廠內處理線區也因而分為此 3 條處理線，廠內大部分使用德國 ANDRITZ MeWa GmbH 公司所生產之 WEEE 處理設備。

據了解由於英國多數電子電器處理廠皆採用 ANDRITZ MeWa GmbH 公司所生產之設備進行半自動化的處理，本次英國參訪由

ANDRITZ MeWa GmbH 公司代表（銷售經理）Schaitel Inge、Gilbos Piet 先進行該公司設備的簡介後，再由 Viridor Limited 處理廠人員陪同至現場參觀。

冰箱處理設備採用橫流壓混機（Cross- flow shredder）進行處理（設備型號為 MeWa UNI-CUT QZ2500HD），利用鏈條撞擊產生的機械力拆解各類物料並快速分離，物料在不斷重複的撞擊過程中會破碎成細小的碎片，亦可藉由改變控制參數（如延長破碎時間）調整破碎粒徑大小。目前 Viridor Limited 處理廠處理之廢電冰箱含 CFC 冷媒及 HC 冷媒的比例約為 1:1，含冷媒之廢電冰箱於橫流壓混機密閉空間內進行破碎，期間並持續注入氮氣，防止破碎過程可能引發之爆炸情況。於橫流壓混機填充氮氣具有下列幾項優點：其一為液態氮為良好的吸收劑，可以吸走水份，提高冷媒回收機之冷媒回收效率；其次為氮氣屬惰性氣體，若破碎設備在完成惰化設計的情況下較不容易產生爆炸，因此可同時進行含傳統冷媒及碳氫冷媒冰箱破碎作業亦不會產生爆炸，且在橫流壓混機上方有一排氣通道作為防爆機制，若不幸發生爆炸，可透過排氣通道釋放其所產生之壓力，確保人員處理安全，並降低傷害損失。

經過破碎後之 PUR 泡棉於設有加熱系統之輸送帶進行運送，透過加熱能將 PUR 泡棉內含殘留之冷媒及水份驅出，加熱時間約為 30 分鐘~1 小時，加熱溫度約為 120℃~130℃左右。

圖 2　參訪 Viridor Limite 處理廠廢電冰箱處理情況

在 CRT 處裡部分，Viridor Limite 處理廠採用 Panasonic 自動化切割設備，將 CRT 置放置平台上後，由紅外線自動偵測位置進行加熱切割，再採以人工拆解成平面玻璃及錐管玻璃，經過螢光粉吸除作業後，隨後經破碎並磨除石墨、去除表面銳角後，分裝成袋送至德國處理，後續作為建材原料進行再利用。

圖 3　參訪 Viridor Limite 處理廠廢 CRT 處理情況

圖 4　與 ANDRITZ MeWa GmbH 公司 Schaitel Inge、Gilbos Piet 合影

三、 參訪 Environcom England Ltd.處理廠

Environcom England Ltd. 處理廠成立於 2003 年，為英國最大的廢電子電器再利用及精通回收廢電機電子設備之公司，廠內回收之廢物品以白色家電為主，包括冰箱、洗衣機、電爐等廢物品，Environcom England Ltd.公司總共有 4 個據點，本次參訪地點位於格蘭瑟姆（Granthan），為該公司於 2003 年成立時之第一個據點，主要負責廢電子電器處理及再利用；而位於倫敦的據點創立於 2011 年，主要為廢電子電器回收中心，於倫敦據點收集的廢電子電器將先進行檢測維修後販售，若廢電子電器經檢測後無法再使用則統一送至格蘭瑟姆（Granthan）破碎再利用。而位於伯明罕（Birmingham）及威爾斯（Wells）的據點則分別於今年（2014）的 1 月及 7 月創立。

格蘭瑟姆（Granthan）廠負責廢電子電器處理及再利用，所有廢物品於進廠時皆已張貼條碼以利進行流向及庫存管控，所有廢物品進廠

時，廠內人員經初步篩選後進行物品之檢測作業，並將物品分類，若屬堪用物品則將物品將先進行維修整理，可再使用之物品經過工程師檢測維修並測試其性能，待確認二手產品功能運作正常後，並將相關維修資訊記錄於條碼內，再依據物品之良好程度進行分級（白金、金、銀、銅四級）訂定售價，最高以市價的六折販售給二手家電業者或民眾，而不堪用之物品則循一般廢電子電器處理程序，經破碎、分選、磁選等流程回收可再利用之再生料。雖於進料過程耗費較多人時進行物品使用年限、效能及分類貯存，且花費大量人力及金錢進行物品的維修，但其所再販售的收益所得卻遠大於處理後再生料的販售價格。

Environcom England Ltd. 處理廠廠內廢電冰箱設備亦使用德國 ANDRITZ MeWa GmbH 公司所生產之 WEEE 處理設備，廢電冰箱採橫流壓混機（Cross- flow shredder）進行處理（設備型號為 MeWa QZ2500），廢電冰箱於進入橫流壓混機處理前，使用抽取設備先刺入冰箱壓縮機，將冷媒及冷凍油予以吸除，並藉由壓力計辨別冷媒是否完全回收，之後將壓縮機與廢電冰箱本體分離。

廢電冰箱體進入密閉破碎設備前，亦須刷取條碼確認每日廢電冰箱處理線之處理數量，箱體在橫流壓混機密閉空間破碎時亦持續注入氮氣，防止破碎過程可能引發之爆炸情況，箱體破碎後之 PUR 泡棉經清洗純化後銷售至德國，後續作為地磚或其他材質之添加物使用；廠內冰箱最大處理量為每小時處理 100 台，而大、小型廢電子電器物品之最大處理量約為每小時處理 1-1.5 公噸。

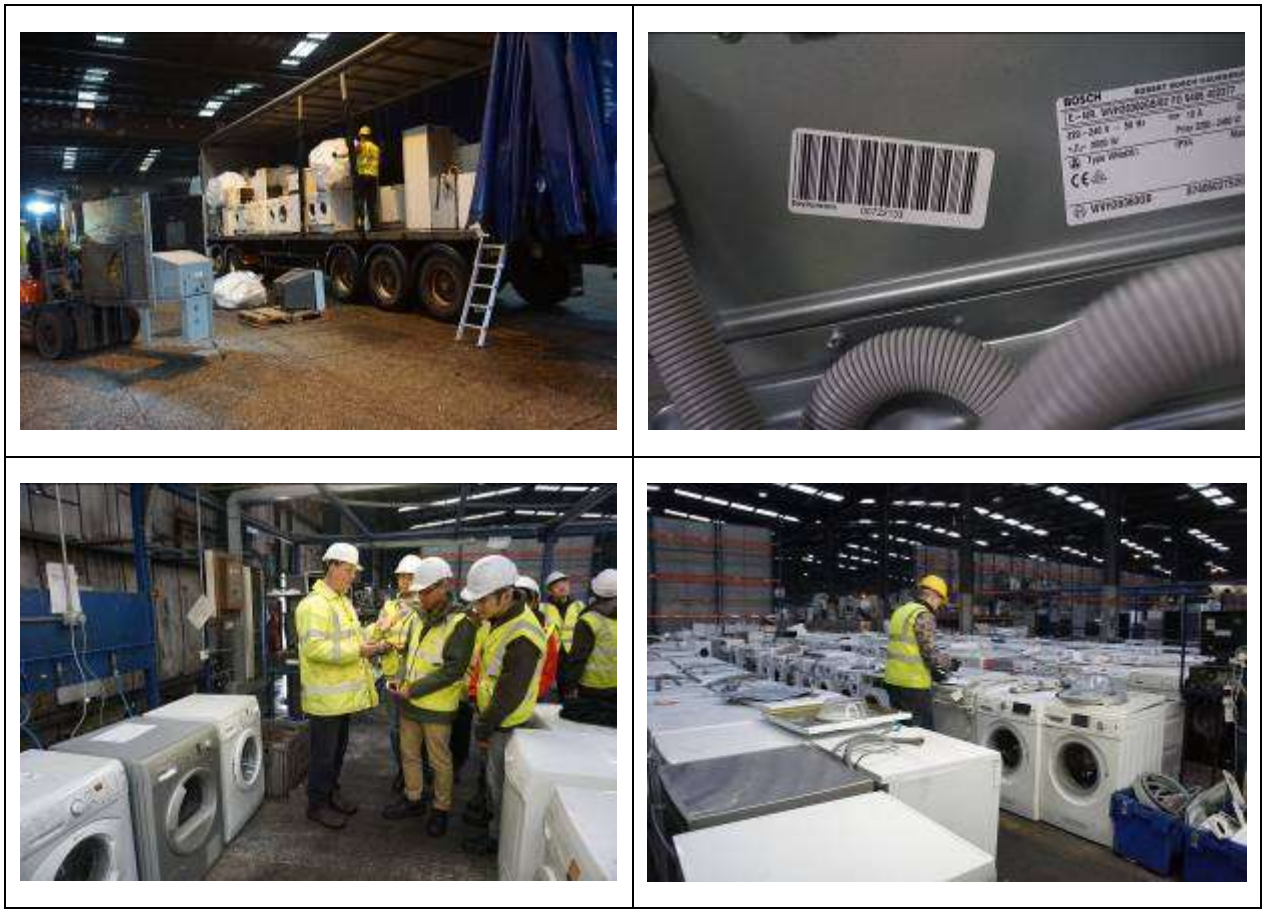


圖 5　參訪 Environcom England Ltd. 處理廠廢物回收情況

圖 6　廢電冰箱回收壓縮機冷媒與冷凍油之處理設備

圖 7　參訪 Environcom England Ltd. 處理廠廢電冰箱回收處理情況

在 Environcom England Ltd.公司所有廢電線皆採用的電線處理設備電線處理設備（MG Compact 220T[1]）細破碎至 1mm 以下，再利用旋風分離原理將塑膠包覆材料（PE）與銅金屬分離，此一設備減少許多人力拆解分離電線時間，且分離出之銅金屬無雜質，在後端進行販售時價格相對可提高。

[1] Bronneberg Deutschland GmbH，
http://www.bronneberg.de/de/produkte/kabelrecyclingmaschinen/kabelgranulieranlagen/kabelgranulieranlage-mg220t-special/

圖 8　旋風分離設備

圖 9　與 Environcom 公司 Jon Parsons、Bill Crosby、Paul Walsingham 合影

四、 參訪倫敦再利用聯盟 London Reuse Network

倫敦再利用聯盟協助社區及民眾將廢物品進行減量、再利用、循環再生，聯盟包含業者多達 30 幾家，聯盟多數業者為廢物品之二手販賣商店，少數業者從事民眾捐贈廢物品的維修工作，因為性質屬於慈善事業，所以可修復後再利用商品的售價皆低於市價許多。

此次參訪的對象為倫敦再利用聯盟之旗下業者 Rework 公司，該公司位於 Wandsworth town 地方回收場之廠區內，Wandsworth town 地方回收場提供民眾自行載運各項可回收之物品至場區回收，現場各回收項目設有不同桶槽分區放置，地方回收站亦設置獨立桶槽供民眾將廢電子電器及傢具捐贈給 Rework 公司。Rework 公司將各地回收之冰箱、洗衣機、電爐等廢物品及各式各樣傢俱進行檢測維修。

捐贈物品經檢測後無法再使用，該物品則會交給其他處理業者進行處理，物品檢測後若判定可透過簡單維修即可再使用，則會在檢修測試後交由二手物品販賣業者進行販售，所有程序都需符合 PAS 141 標準驗證，針對不同類型商品提供不同產品保固內容。

Rework 公司回收站內設有傢俱維修部門，可將傢俱重新維修、組裝、上漆，經處理後之傢俱亦可透過該公司之網路平台（網址：http://www.reworklondon.org/）進行販售或由實體店面進行銷售，其方式與我國部份環保局所進行大型家具再生修繕後再進行販售相同（例如：台北市再生家具網，網址：http://recycle.epb.taipei.gov.tw/furniture）

圖 10　參訪倫敦再利用聯盟 London Reuse Network 回收情況

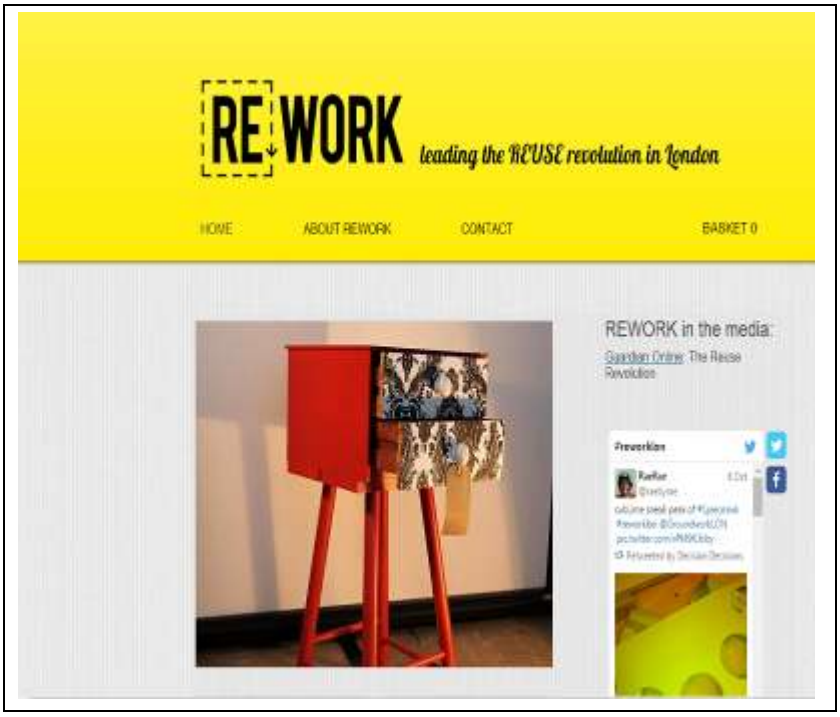


圖 11　Rework 公司網路販售平台

圖 12　倫敦再利用聯盟 London Reuse Network 實體店面銷售點

五、 拜會 Nulife Glass 處理廠

Nulife Glass 公司具備分離錐管玻璃內之鉛金屬處理技術，因此本次參訪行程中聯繫 Nulife Glass 公司負責人，亦是此技術之研發者 Simon Greer 先生於倫敦進行面談，據 Simon Greer 先生表示，Nulife Glass 公司透過自行研發的高溫電熔爐進行玻璃與鉛金屬之分離。

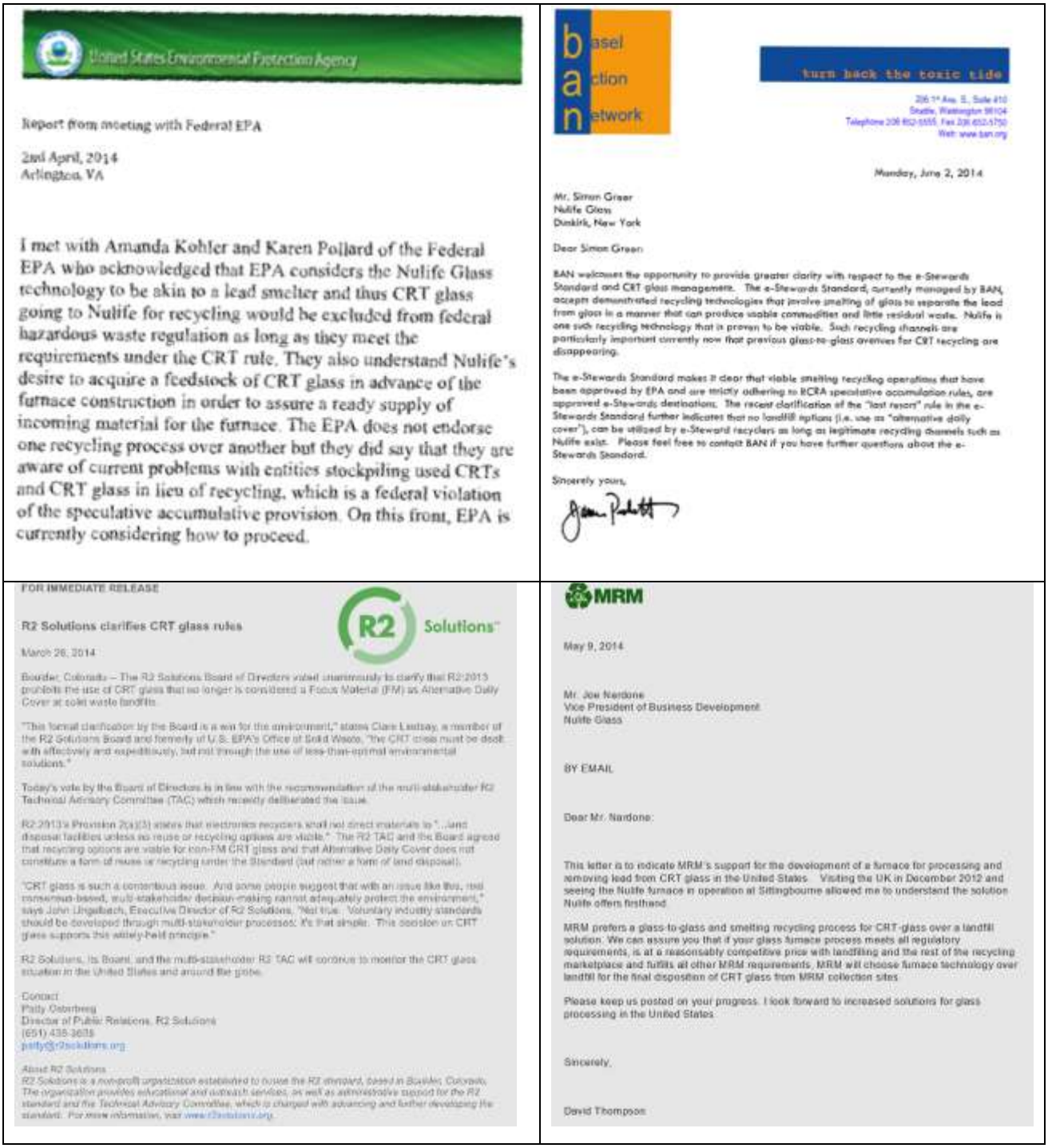
Nulife Glass 公司從上游處理業者取得 CRT 顯示設備中的錐管玻璃後，於廠內將其破碎至粒徑 3 mm 左右，粉碎後之含鉛玻璃與另外兩樣不具危險性之化學品（基於商業機密，該公司未透露此化學物品為何種物質）混和後送入高溫電熔爐，該爐體加熱方式採電熱式，而操作方式的作業環境則維持「冷頂」之狀態（冷頂是指在窯爐的正常生產過程中，保持加料部位的爐頂溫度及液面維持較低的溫度，當窯爐形成冷頂後，由於頂部溫度較低，因此窯爐散熱大大降低，熱效率大大提高，同時低溫也抑制了揮發物的逸散鉛玻璃等的熔製），此種爐體進料操作方式除了可提供密封性外亦可做為絕緣體，避免熱及污染物逸散，可使得爐體相對的節能。

圖 13　Nulife Glass 公司透過自行研發的高溫電熔爐

而透過 Nulife Glass 公司所使用之特定化學物品，可使鉛金屬由含鉛玻璃中完全分離而不會破壞玻璃結構，萃取出的鉛由於比重較大沉降至熔爐底部並澆鑄成鉛錠後進行銷售，回收鉛的純度可達 99.7%，可作為鉛蓄電池及其他鉛製品的原料；處理過的玻璃置於冷水中冷卻後，形成適合用於結合水泥的粒狀材料，另外亦可作為磁磚及裝飾用鵝卵石等高經濟價值之材料，透過與玻璃藝術家的合作，可開發出許多玻璃相關藝術品；而鉛金屬透過精鍊可再製成鉛錠。

圖 14　不含鉛之玻璃(左圖)及自行精鍊後之鉛碇(右圖)

據 Simon Greer 先生表示，Nulife Glass 公司錐管玻璃處理技術以英國當地用電費用（1 度電約新台幣 2.5 元）計算，其處理成本約為新台幣 6.6 元/公斤，分離後可得到 61%玻璃、約 37~39%鉛金屬及 0.1%的雜質；而該公司現已不再進行設備販售或技術轉移，未來僅由 Nulife 公司自行評估設廠，現除美國紐約州已完成設廠並取得相關操作許可外，美國賓州、澳洲或紐西蘭也正進行設廠的評估中，紐約州廠的電熔爐目前已從英國曼徹斯特拆下，現正透過海運送到美國的路上，待電熔爐運送至紐約州廠址進行裝設後，預計將於 2015 年第一季開始正式營運，相關操作許可如圖 24 所示。Nulife 評估設廠與否之主要考量條件爲持續 3 年可收受約 1,000 公噸/月的錐管玻璃量，主要原因為高溫電熔爐之成本考量，其設備運轉採每天 24 小時連續進料方式進行熔煉操作，除非有緊急情況才會停機，因此其設廠條件必需以能提供連續操作一定數量的市場作為考量。考量目前現有市場規模，亞洲可能會是 Nulife Glass 公司評估的下階段設廠區域。



Report from meeting with Federal EPA

2nd April, 2014
Arlington, VA

I met with Amanda Kohler and Karen Pollard of the Federal EPA who acknowledged that EPA considers the Nulife Glass technology to be akin to a lead smelter and thus CRT glass going to Nulife for recycling would be excluded from federal hazardous waste regulation as long as they meet the requirements under the CRT rule. They also understand Nulife's desire to acquire a feedstock of CRT glass in advance of the furnace construction in order to assure a ready supply of incoming material for the furnace. The EPA does not endorse one recycling process over another but they did say that they are aware of current problems with entities stockpiling used CRTs and CRT glass in lieu of recycling, which is a federal violation of the speculative accumulative provision. On this front, EPA is currently considering how to proceed.

turn back the toxic tide

Monday, June 2, 2014

Mr. Simon Greer
Nulife Glass
Dunkirk, New York

Dear Simon Greer:

BAN welcomes the opportunity to provide greater clarity with respect to the e-Stewards Standard and CRT glass management. The e-Stewards Standard, currently managed by BAN, accepts demonstrated recycling technologies that involve smelting of glass to separate the lead from glass in a manner that can produce usable commodities and little residual waste. Nulife is one such recycling technology that is proven to be viable. Such recycling channels are particularly important currently now that previous glass-to-glass avenues for CRT recycling are disappearing.

The e-Stewards Standard makes it clear that viable smelting recycling operations that have been approved by EPA and are strictly adhering to RCRA speculative accumulation rules, are approved e-Stewards destinations. The recent clarification of the "last resort" rule in the e-Stewards Standard further indicates that no landfill options (i.e. use as "alternative daily cover"), can be utilized by e-Steward recyclers as long as legitimate recycling channels such as Nulife exist. Please feel free to contact BAN if you have further questions about the e-Stewards Standard.

Sincerely yours,

FOR IMMEDIATE RELEASE

R2 Solutions clarifies CRT glass rules

March 26, 2014

Boulder, Colorado – The R2 Solutions Board of Directors voted unanimously to clarify that R2:2013 prohibits the use of CRT glass that no longer is considered a Focus Material (FM) as Alternative Daily Cover at solid waste landfills.

"This formal clarification by the Board is a win for the environment," states Clare Lindsay, a member of the R2 Solutions Board and formerly of U.S. EPA's Office of Solid Waste. "The CRT crisis must be dealt with effectively and expeditiously, but not through the use of less-than-optimal environmental solutions."

Today's vote by the Board of Directors is in line with the recommendation of the multi-stakeholder R2 Technical Advisory Committee (TAC) which recently deliberated the issue.

R2:2013's Provision 2(a)(3) states that electronics recyclers shall not direct materials to "...land disposal facilities unless no reuse or recycling options are viable." The R2 TAC and the Board agreed that recycling options are viable for non-FM CRT glass and that Alternative Daily Cover does not constitute a form of reuse or recycling under the Standard (but rather a form of land disposal).

"CRT glass is such a contentious issue. And some people suggest that with an issue like this, real consensus-based, multi-stakeholder decision-making cannot adequately protect the environment," says John Lingelbach, Executive Director of R2 Solutions. "Not true. Voluntary industry standards should be developed through multi-stakeholder processes: it's that simple. This decision on CRT glass supports this widely-held principle."

R2 Solutions, its Board, and the multi-stakeholder R2 TAC will continue to monitor the CRT glass situation in the United States and around the globe.

Contact
Patty Osterberg
Director of Public Relations, R2 Solutions
(651) 438-3608
patty@r2solutions.org

About R2 Solutions
R2 Solutions is a non-profit organization established to revise the R2 standard, based in Boulder, Colorado. The organization provides educational and outreach services, as well as administrative support for the R2 standard and the Technical Advisory Committee, which is charged with advancing and further developing the standard. For more information, visit www.r2solutions.org.

MRM

May 9, 2014

Mr. Joe Nardone
Vice President of Business Development
Nulife Glass

BY EMAIL

Dear Mr. Nardone:

This letter is to indicate MRM's support for the development of a furnace for processing and removing lead from CRT glass in the United States. Visiting the UK in December 2012 and seeing the Nulife furnace in operation at Sittingbourne allowed me to understand the solution Nulife offers firsthand.

MRM prefers a glass-to-glass and smelting recycling process for CRT-glass over a landfill solution. We can assure you that if your glass furnace process meets all regulatory requirements, is at a reasonably competitive price with landfilling and the rest of the recycling marketplace and fulfills all other MRM requirements, MRM will choose furnace technology over landfill for the final disposition of CRT glass from MRM collection sites.

Please keep us posted on your progress. I look forward to increased solutions for glass processing in the United States.

Sincerely,

David Thompson

圖 15　Nulife Class 紐約州廠址相關操作許可審查信件、BAN 及 R2 技術認可信件及 MRM 合作意向書

六、 拜會與廢棄物及資源行動計畫辦公室（Waste & Resources Action Programme, WRAP）

WRAP 成立於 2000 年，由英國環境、食品及鄉村事務部(DEFRA)、蘇格蘭政府、威爾斯政府所成立之一間非營利性公司，成立宗旨即是為了減少廢棄物之產生並提升廢棄物之回收量，達成經濟及環境效益，所扮演之角色位於政府單位、產業及財務部門之中，居中提供各種資訊以利上述單位對於廢棄物衍生問題的因應之道。

英國依歐盟所制定的 WEEE 指令制訂國內相關法令，在 WEEE 指令實施前，製造商不需負擔回收廢電子電器物品之責任，然而在 WEEE 指令實施後，規定製造商必須負起造成環境衝擊之責任，因此製造商如於英國販售電子電機商品時，必須先與回收組織簽訂協議以盡其回收義務，WRAP 透過推動各項回收計畫幫助企業更有效的回收物品，此外幫助政府解決廢物品回收困境，協助立法機構針對環境方面制定更完善的法律。

英國廢電子電器物品可透過回收站、販售業者等地點進行回收，在 2014 年前依照歐盟 WEEE 指令的規定，英國須達到每人每年回收 4kg 的目標，但隨者 EEE 產品的輕量化趨勢，歐盟修訂 WEEE 回收指令，自 2014 年起英國針對 WEEE 回收數量統計將由回收量改為回收率，2016 年之目標回收率為前三年 EEE 平均物品上架營業量(重量)約 45%，2019 年目標回收率為 65%，圖 15 為目前英國 WEEE 回收量圖表，圖 16 為 EEE 平均物品上架營業量(重量)與 2016 年及 2019 年目標回收率相關圖表。

而英國的廢電子電器回收體制包括製造商、經銷商、回收商、處理業者等 4 大主要單位，各自負責應盡的義務，製造商如 Sony 公司，在進口產品時繳交該公司產品市占率百分比的金額做為廢物品再利用時之補貼費，而經銷商（如：TESCO）則於販售商品同時回收民眾產出的廢物品，回收商則收集經銷商、地方回收站之廢物品交由處理業者，處理業者（如：Environcom）則將廢物品檢修整理後販售至二手市場或將廢物品處理後產出之再生料販售至再生料市場。

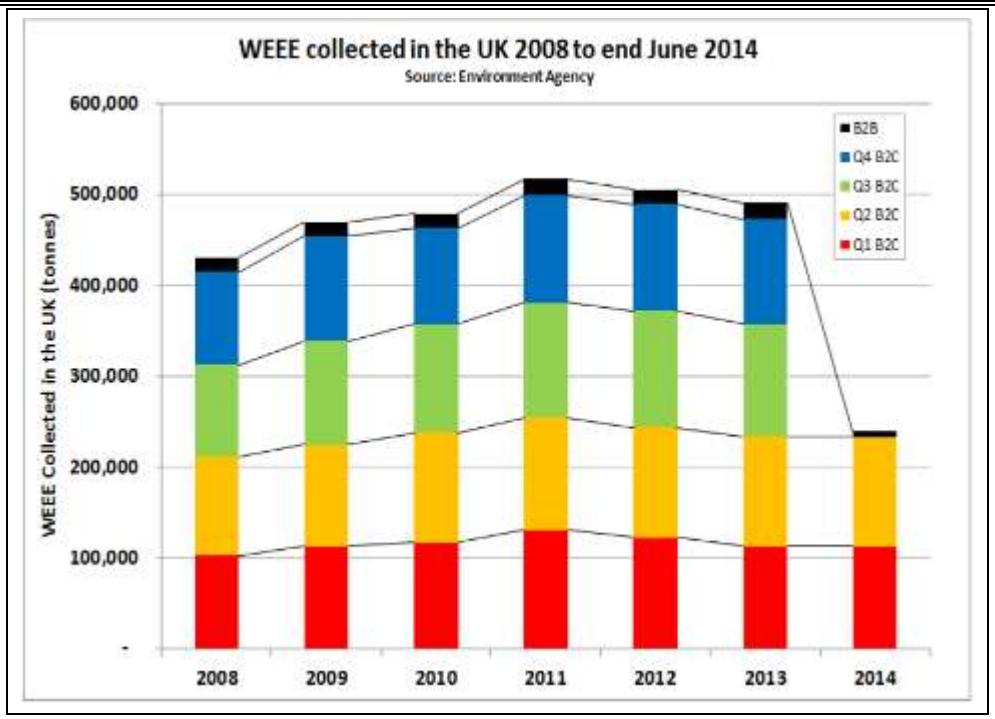


圖 16　英國 WEEE 回收量自 2008 年至 2014 年 6 月統計圖

(資料來源：WRAP 簡報)

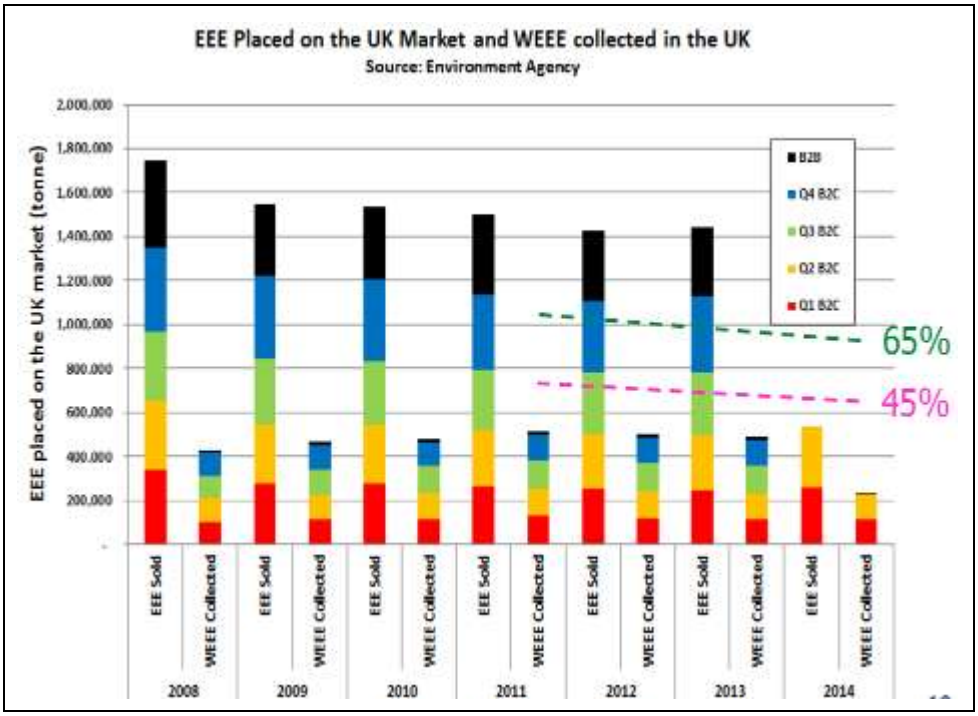


圖 17　英國 EEE 平均物品上架營業量與各目標年度回收率圖表

(資料來源：WRAP 簡報)

目前英國 WEEE 回收體系主要的類別分為大型家電、小型家電、顯示設備(電視及屏幕)、冷卻設備(冰箱、冷氣機)、照明設備(氣體放電燈)及未來將要進入回收體系的 LED 燈及太陽能板。

WRAP 目前研究進行中的回收計畫包括：因應液晶顯示產品背光燈管由 CCFL 轉換為 LED，因此最新研究方向將開始針對 LED 的回收進行研究，另外歐盟爲方便處理業者辨識背光燈管是否含汞，因此針對目前電視的販售，設計含汞及無汞標章讓製造業者可標示於電視產品之外殼上，讓回收處理業者於處理電視產品時能夠輕易辨識及處理，汞標章如圖 17 所示。歐盟亦透過創新技術研發計畫的補助，進行各式各樣回收處理及降低廢棄物產生的研究，據 WRAP 估計，廢棄物破碎過程所損失的物料價值約達 8,000 萬英鎊，因此減少廢棄物的產生將可有效的降低成本。

圖 18　含汞標章與非含汞標章(資料來源：WRAP 簡報)

伍、行程成果評估及心得建議

一、英國回收制度係依歐盟所制定之廢棄電子電機設備指令（Waste Electrical and Electronic Equipment Directive,WEEE）進行制訂，其製造輸入業者與我國一樣皆需付起環境影響代價之責任，惟所繳交之回收清除處理費用係交給國內的回收組織，繳交金額作為後端回收業者、地方政府、處理業者之補貼費用，並由回收組織委託特定機關進行處理量監督（檢查頻率約每季 1 次），英國政府對於後端再生料市場不負任何管理及監督之責任，由處理廠自行變賣或委託處理。

二、英國在處理含氟氯烴冷媒及碳氫冷媒的廢電冰箱設備多使用來自於德國 ANDRITZ MeWa GmbH 公司所生產的處理設備，採連續式的作業，由投料口進入後採橫流壓混機進行處理，利用鏈條撞擊產生的機械力將廢電冰箱各類物料進行分離，產出各式再生料，處理過程中全程利用注入氮氣防止因破碎過程引發爆炸，在處理設備上方設置排氣防爆洩壓通道，因此，英國處理廢電冰箱時可不需考慮冷媒種類。我國部分處理廠雖有橫流壓混機處理設備，惟設計採三階段處理（二軸初破碎、輸送帶乘載和橫流壓混機），造成冷媒收集效益不佳，又加上並無排氣之防爆洩壓設計，造成我國處理廢電冰箱時需先進行冷媒種類分類。

三、英國處理廠在蒐集廢電冰箱內之冷媒後，均會集中送至後端處理單位進行焚燒銷毀作業，而我國冷媒蒐集後則交由冷媒回收業者，經過分離純化後，重新回填，未來我國可以針對蒐集後之冷媒燃燒排放至大氣進行經濟效益與環境影響之評估。

四、廢電冰箱箱體破碎後所產出的聚氨酯發泡材（Polyurethane,PUR），經清洗純化分成 2 種等級，較差等級於英國當地焚化處理，較好等級則銷售至德國，可以做為地墊、工業用原料之添加物或裂解後做爲燃料等使用，我國目前現行係聚氨酯發泡材（Polyurethane,PUR）採取焚化銷毀，未來可針對德國所再利用方式進行瞭解評估。

五、目前我國陰極射線管（Cathode ray tube, CRT）電視廢棄後產生的廢錐管玻璃有明顯的去化管道不足處，此次藉由與 Nulife Glass 公司 Simon Greer 先生會談，瞭解其所研發利用高溫熔爐將錐管玻璃內之玻璃與鉛能夠完全分離，此融熔法萃取鉛元素技術為目前錐管玻璃最特殊之處理方法，該公司日前雖曾進行技術轉移，但現已不再進行設備販售或技術轉移，採自行設廠或合作設廠方式，除美國紐約州已完成設廠並取得相關操作許可外，其他美國賓州、澳洲或紐西蘭均進行設廠的評估，亞洲亦可能會是該公司評估的下階段設廠區域。建議未來可邀請來臺進行交流以提升我國處理技術。

六、英國對於廢棄物的管制，希望可以從源頭減量，再者就是再使用並延

長使用年限，所以對於可再使用之電子電機設備多會先行採用「維修後再使用」而非直接廢棄，本次參訪之處理廠 Environcom England Ltd. 公司雖是處理廠，但也會針對回收的商品進行篩選，將可維修的商品挑選出來，維修及再銷售都須通過 PAS-141 標準驗證，維修後再販售之物品皆採條碼管控，並記錄銷售店家及購買者的資訊，商品也都有業者提供產品保固，此再使用可讓物品達到最大效益，減緩廢棄物產生數量及時間。

七、 於有進行維修再利用的處理廠，廢電子電機設備進廠時便以條碼或編號方式進行管理，利用條碼或編號辨別或讀取該廢物品的使用年限、效能並進行是否可再使用之判別並分類貯存，進料過程雖耗時但其所維修後再販售所得收益遠大於處理後再生料的販售價格。

八、 於英國處理廠對於廠務管理極為嚴謹，廠內除設立人、車分屬專用路線外，亦隨處可見工安標示，就連參訪人員都需穿戴螢光背心、安全帽、防護眼鏡等，但處理廠內的環境管理仍有可加強處，部分地面有積水情形及設備處理廢棄物掉落等情事。

九、 歐盟針對廢電視是否含汞部分，設計一個「非含汞」標章，此標章嵌於電視產品之外殼上，讓回收處理業者於回收處理時能夠輕易辨識及處理不含汞電視產品（係指背光源為發光二極體（Light-Emitting Diode,LED））,雖尚待確認歐盟所執行的細節內容，但此法若能讓後端回收業者在處理上更為方便，我國可考量是否可比照綠色標章部分由製造廠商自行進行相關標示。

十、 本次我國赴國外參訪前，進行參訪業者聯繫作業耗費多時，於聯繫過程中亦有業者提出需收費才接受拜訪之情事，建議未來如有參訪行程，可透過我國駐外代表處協助聯繫並提供相關建議以節省聯繫確認作業。

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四、 廢電子電器及資訊物品最佳可行處理回收再利用技術指引(Guidance on Best Available Treatment Recovery and Recycling Techniques and treatment of Waste Electrical and Electronic Equipment），BATRRT) P.15

五、 英國廢棄物及資源行動計畫辦公室網站:(http://www.wrap.org.uk/)

附件一 ANDRITZ MeWa 設備型錄


ANDRITZ
ANDRITZ MeWa recycling technologies
Individual designs. Optimal solutions.
www.andritz.com/mewa

The range of plants

You set us the task — we plan and construct your plant

Reliable, delivering on schedule, and with three decades' experience behind us. Our customers' satisfaction is both our duty and our incentive. Over 300 large-scale plants worldwide speak for themselves. We tailor our process solutions to the individual needs of our customers, but we also offer a range of innovative standard solutions to respond to the most urgent recycling issues. Cost-effective, efficient, reliable, and designed for continuous operation, ANDRITZ MeWa plant systems offer complete processing solutions for (almost) any situation.

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Complete recovery of plastics and metals.

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The right solution for any task.

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Electrical and electronic scrap
WEEE recycling plants

All kinds of electrical and electronic scrap – white and brown goods, computers, refrigerators, or only cables – are processed with ANDRITZ MeWa equipment, which paved the way in recycling technology in accordance with the European WEEE Directive at a very early stage. The ANDRITZ MeWa plant solutions offer impressive cost-effectiveness and the highest environmental standards.

Processing plants for **electrical and electronic scrap**

Old electrical appliances contain iron, aluminum, copper, gold, silver, plastics, and many other raw materials. Yet they also contain components that in turn contain harmful substances, for example batteries and capacitors. ANDRITZ MeWa has developed particularly effective and environmentally friendly technologies, which have led the way throughout Europe, for recovering the recyclable materials and separating out the hazardous substances.

A single-stage process extracts the recyclable materials from the domestic appliances, consumer electronics, and computers and sorts them by category. Parts containing harmful substances are left untouched by the process.

Output

- Exposed circuit boards
- Transformers
- Capacitors
- Aluminum
- Copper
- Iron
- Stainless steel

Processing plants for **refrigerators**

ANDRITZ MeWa recycling plants for cooling devices can reclaim 99.9% of environmentally harmful greenhouse gases. A particular benefit is that even modern refrigerators – in which the insulation materials have been expanded using highly-explosive pentane gas – can be processed in ANDRITZ MeWa systems at the same time as CFC appliances without a risk of fire.

The recovered individual fractions of iron, copper, aluminum, plastic and PU foam can be returned directly to the economic cycle.

Output

- Compressors
- Aluminum
- Copper
- Iron
- Polyurethane
- Plastic parts
- CFCs/Pentane

Recycling plants for **cables**

For many years, ANDRITZ MeWa has been supplying complete recycling lines for all kinds of scrap cable. The metals in these cables – copper, aluminum, lead, and iron – are a rich source for recycling.

Using pre-shredding, granulation and fine granulation systems as well as modules for sorting and separation of the raw materials, ANDRITZ MeWa plants reclaim the individual metals with purity levels of almost one hundred percent. Cable recycling will not only secure valuable resources, it also saves huge amounts of energy. Actually, metal recycling only uses a fraction of the energy needed for the extraction and recovery of ores.

Output

- Copper
- Aluminum
- Iron
- Lead
- Plastic parts

Household and commercial waste
Getting out what's inside

ANDRITZ MeWa had already started designing modern processing systems for domestic, commercial, and bulky waste more than 30 years ago. For several years now, ANDRITZ MeWa has also been using its technologies to process organic waste and fuel crops for fermentation in biogas plants.

Plants for the production of **substitute fuels**

The aim of ANDRITZ MeWa recycling plants is to separate the organic from the non-organic components of waste. Organic materials are processed to make high-grade humus. The residues are separated out into re-usable fractions such as metals, glass, paper, plastics, minerals, and textiles.

Non re-usable materials that nevertheless have high calorific values are processed by the ANDRITZ MeWa systems to make substitute fuels. These are transformed into usable energy in large-scale power plants or in the cement industry.

Output
- Glass
- Paper
- Plastics
- Minerals
- Textiles
- PVC
- Wood

Metal-cleaning plants

In recycling plants for substitute fuels or in sorting plants, metals are removed from the process at a very early stage by magnetic separators. However, very lightweight plastics and textiles remain attached to wires and sharp-edged metals.

These compounds are successfully dismantled by the ANDRITZ MeWa QZ. Even large solid items such as steel beams or guide rollers are no problem. The low wear rate, ease of maintenance, and the high quality of the output materials make these plants extremely cost-effective. The end results are steel scrap and non-ferrous metals of 98% purity, perfectly prepared for the steel industry.

Output
- Iron
- Non-ferrous metals
- Plastics
- Textiles

Processing of substrates for **biogas plants**

ANDRITZ MeWa has developed its own technology to process packaged food, organic waste, or fuel crops in the best way possible for the fermentation process in biogas plants. The patented Bio-QZ removes packaging material and breaks down the cell structure of the substrates, thereby providing the bacterial strains with a substantially larger contact surface. This accelerates and intensifies gas formation measurably.

Thus, the duration of the overall process is reduced greatly reduced, while the efficiency of the biogas plant can be increased by more than 30%.

Input
- Maize and whole-crop silage
- Cattle, horse, and chicken manure
- Sugar beet
- Grass clippings
- Leftover food
- Organic waste
- Packaged food

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Tires
Recycling instead of incineration

ANDRITZ MeWa has also shown a pioneering spirit in the processing of scrap tires. The guiding principle for worn, used tires and the waste from manufacturers' production processes is the same – recycling instead of incineration. The secondary raw materials obtained go back directly into new tires or other products.

Processing plants for **used tires**

The objective of tire recycling is to break down the used tires into their individual components – rubber, steel wire, and textiles. ANDRITZ MeWa plants recover the raw materials in a three-stage recycling process that achieves highest levels of purity.

First of all, rotary shears break down the tires into large, hand-sized shreds. A granulation line breaks these down in stages to produce rubber granulates of less than 4 mm grain size.

The first stage is a thorough separation and cleaning process, which ensures the optimum quality standards of the end product.

A particular innovation by ANDRITZ MeWa is subsequent processing of the cleaned, granulated rubber to turn it into rubber powder. It can be processed directly into moulded pieces without the addition of adhesives, or pressed into shapes. As a genuine secondary raw material, it is reused in the manufacture of technical rubber products. Depending on the type of product, up to 60% of the raw rubber can be saved.

Output

- Tire shreds
- Rubber granulate
- Rubber powder
- Steel wire
- Textile fluff

Recycling plants for **non-vulcanized steel cord waste**

The production processes of all tire manufacturers worldwide produce rubberized steel cord waste, which is difficult or impossible to dispose of. Working with one of the leading tire manufacturers, ANDRITZ MeWa has developed and patented an efficient raw material recycling solution.

This process separates the non-vulcanized rubber compound from the steel cord and returns it, without loss of quality, to the manufacturing process for new tires – an innovation that is of interest to all tire manufacturers worldwide, while solving a waste problem faced by this industry globally.

Output

- Non-vulcanized rubber compound
- Steel cord

Car parts
Solutions for metal compounds

Whenever metal is involved, the ANDRITZ MeWa technology can prove its strengths. Especially components from end-of-life cars contain a variety of valuable raw materials for which ANDRITZ MeWa has developed pioneering solutions.

Recycling plants for **oil filters, shredder light fraction, catalytic converters, engine blocks, aluminum rims, etc.**

Replaced oil filters from cars and trucks are classified as special waste worldwide. However, they consist of some 80% metals (mainly iron). The oil makes up around 20% of the material mixture. The actual paper filter, rubber sleeves, and other plastic parts make up the remainder.

ANDRITZ MeWa implemented the first oil filter recycling plant in Europe back in 1996. This cutting-edge technology is now found worldwide.

A wide range of valuable raw materials can be found in the components of scrap cars. Obtaining the precious metals from catalytic converters, the aluminum from wheel rims and engines, or the steel springs from seats – ANDRITZ MeWa recycling technology offers the right solution for any situation.

Output
- Oil
- Iron
- Non-ferrous metals
- Paper
- Rubber
- Plastics

Paper industry
Treatment of pulper rags

Metals can also be found in industries, in which they would not necessarily be expected as for example in the form of rags in the paper industry. Here, recycling plants from ANDRITZ MeWa show their specific capabilities and separate the bulky rags into valuable fractions.

Recycling plants for **rejects and rags from the paper industry**

Waste paper is usually delivered to paper mills in pressed bales held in shape by wires. The stock preparation process generates rags that comprise wires and other rejects. Rejects are all those materials that are not paper, such as plastics, textiles, and metals.

Depending on the requirements, ANDRITZ MeWa plants include several shredding stages in order to break down the stubborn rags properly. The robust machine technology with its very hard wearing cutting gear releases the metals (accounting for up to 40% of the content) completely. Impurities are separated into different fractions by subsequent separation processes. The calorific materials are further processed to provide substitute fuels.

Output
- Substitute fuels
- PVC
- Steel
- Other metals

Special plants
Complete process solutions

Consumer goods at the end of their useful life or waste flows from industry often contain materials such as iron, aluminum, copper, brass, bronze, and many more. When a product comes to the end of its useful life, these materials retain their high value as they can be reused indefinitely without loss of quality.

ANDRITZ MeWa technologies incorporate heavy, solid mechanical engineering that is suitable for almost all applications, in particular the demanding process of metal recycling. Innovative, forward-looking thinking has enabled ANDRITZ MeWa to achieve optimum solutions from simple shredding to complex process solutions for a wide variety of challenges.

Solar panels Fiberglass PVC waste
Mattresses Circuit boards
Spray cans Metal turnings
Metal slag Scrap from cans
Deoxidation aluminium
Batteries Medical waste

Computer circuit boards, solar panels, batteries, glass-fiber reinforced plastics (GRP), spray cans, mattresses, metal turnings, LCD monitors, metal waste, shredder light fraction, weapons, toner cartridges, cast aluminium parts, blood sugar meters, waste cans – ANDRITZ MeWa offers the right recycling technology.

The range of machines

The pre-shredders

For such tasks as reducing volumes, preparing waste for incineration, or disintegrating materials for subsequent separation and sorting, ANDRITZ MeWa machines provide the basis for a successful recycling process.

UNI-CUT® AC **AlphaCutter**

Areas of application
- Pressed bales
- Plastic, textile, and paper rolls
- Truck tarpaulins
- Rejects from the paper industry
- Solidified material from spraying
- Bulky waste

UNI-CUT® UC **Rotary Shear**

Areas of application
- Tires
- Mattresses
- Commercial waste
- Sheet metals
- Oil filters
- Ground cables
- Aluminum profiles
- PVC waste

UNI-CUT® CC **CableCutter**

Areas of application
- Ground cables
- Telecommunication cables
- String wires

The granulation line

For the granulation of used tires, the recovery of pure copper or the production of substitute fuels – wherever defined grain sizes of between 4 and 100 millimeters are required, the dynamic ANDRITZ MeWa systems produce the desired results, at excellent performance and high flexibility.

UNI-CUT® UG **Granulator**

Areas of application
- Tires
- Electronic scrap
- Metal profiles
- Scrap cables
- Oil filters
- Mixed plastics

UNI-CUT® USM **Cutting Mill**

Areas of application
- Aluminum cables
- Copper cables
- Tire rubber
- PVC waste

ANDRITZ

The range of machines
Decomposing materials

ANDRITZ MeWa has thoroughly revolutionized traditional shredding technology with its own patented system, at a level of success that literally makes a bang. The principle completely does away with knives, and achieves especially good results in comparison with standard systems. Wherever compounds need to be broken down, the ANDRITZ MeWa QZ cross-flow shredder comes into its own.

UNI-CUT® QZ **Cross-flow shredder**

Areas of application

- Electrical and electronic scrap
- Refrigerators
- Waste from tin and aluminum cans
- Car parts (instruments, engine blocks, catalytic converters)
- Contaminated metal separation fractions
- Spray cans
- Metal turnings
- Packaged load
- Organic waste

Originally designed for the recycling of refrigerators and electronic scrap, the patented QZ cross-flow shredder has developed from an innovation to an excellent all-rounder. In the majority of applications, the machine breaks down metal and plastic compounds, shreds glass-fiber reinforced plastics (GRP) and prepares organic waste and fuel crops for fermentation in biogas plants. It is hardly possible to imagine a more versatile shredder.

The QZ exploits the physical forces of the impact energy, thus guaranteeing particularly fast and efficient material separation at lowest wear. Floor-mounted acceleration tools create a hurricane inside the machine, and material compounds are more or less broken down by themselves through repeated collisions. The dismantled component parts or shredded fermentation substrates leave the QZ after just a few seconds.

We offer full service
All from one source

ANDRITZ MeWa offers a wide range of solutions with cutting-edge technology and a high-quality service from a single source.

ANDRITZ MeWa can benefit from the global network of manufacturing and service locations of the ANDRITZ Group. Our engineers design the machines and parts themselves and, when planning a plant, can refer back to previously manufactured components which have proven their worth in numerous applications and whose performance features are well known from a wide range of operations.

From manufacturing the machines to planning the plant through to assembly and service, we offer our customers a complete range of solutions from a single source.

This level of service guarantees high standards of performance and quality, and ensures reliable, enduring, and cost-effective operation of the plant.

Cutting-edge technology and high-quality service

In control engineering, ANDRITZ MeWa only uses parts from internationally acclaimed manufacturers. Using both the telephone and the internet, we can control and monitor any plant around the world from our company location in Gechingen, Germany. In this way, our engineers can observe, make modifications, and, if necessary, correct malfunctions, even over distances of several thousand kilometers.

Our thirty years of experience in implementing recycling processes also means low transport costs and short assembly and installation times for our customers. Of course, all our machine solutions are also available as individual units.

And what we promise for the plant solutions we also ensure for our mechanical engineering: Our after-sales service supports you throughout the entire useful life of a plant, offers training courses, provides expertise, and comes to your aid with effective assistance.

Active worldwide

Catalytic converters in North America, steel turnings in Russia, used tires in Kazakhstan, solar panels in Malaysia, refrigerators in Greece – all the plants and process solutions from ANDRITZ MeWa are subjected to the same quality criteria that we apply in our own works in Germany.

With a strong team of sales partners and reliable service departments in all the regions of the world, we help our customers benefit from individual solutions tailored to their needs.

This experience, gained internationally, is always incorporated into our new innovations. Working together with external laboratories and independent experts, ANDRITZ MeWa constantly subjects its products to testing, thereby obtaining objective confirmation for its pioneering projects. With satisfied customers in over 40 countries.

Benefits

- Innovative solutions
- Large spare parts store
- Turnkey plants
- Low levels of wear
- High-quality service
- Over 30 years experience
- Cutting-edge technology
- Reduced operating costs
- Process expertise

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Universal Querstromzerspaner UNI-CUT® SERIES QZ

The Hurricane: QZ

The pre-disintegrater without cutting tools

MACHINES PLANTS PROCESS SOLUTIONS

MeWa Recycling Anlagen Der Partner

Universal Querstromzerspaner UNI-CUT® SERIES QZ

The Hurricane: QZ

- Total weight up to 60 tons
- Drive from 250 to 400 kW
- Kettle walls made of hard-facing steel
- Inner lining made from high-strength special steel
- Large easy-entry maintenance door

MACHINES PLANTS PROCESS SOLUTIONS

MeWa Recycling Anlagen Der Partner

Universal Querstromzerspaner UNI-CUT® SERIES QZ

The perfect size for every purpose

QZ 900 HD

QZ 1200

QZ 1400

QZ 1600

QZ 2000 HD

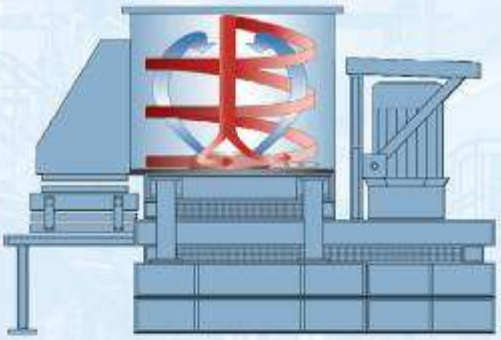
QZ 2500 HD

MACHINES PLANTS PROCESS SOLUTIONS

MeWa Recycling Anlagen

Universal Querstromzerspaner UNI-CUT® SERIES QZ

QZ – Functional Principle



- Flexible, horizontally revolving chains
- Chains create enclosed hurricane
- Thorough disintegration of compounds
- Recyclable fractions stay intact
- Single-stage processing
- Batch or continuous mode possible
- No cutting tools required

MACHINES PLANTS PROCESS SOLUTIONS

MeWa Recycling Anlagen

Universal Querstromzerspaner UNI-CUT® SERIES QZ

QZ – Working Principle

- Chain links measure 25 to 100 mm in diameter
- Specially alloyed and hardened Steel
- Easy to exchange
- Drive adjusted to charging material
- Resistant to impurities
- Low wear costs
- Quick and careful disintegration
- Easy to maintain and service
- 80% ready for sale products

MACHINES PLANTS PROCESS SOLUTIONS

MeWa Recycling Anlagen Der Partner

Universal Querstromzerspaner UNI-CUT® SERIES QZ

Capabilities

Household and consumer electronics

MACHINES PLANTS PROCESS SOLUTIONS

MeWa Recycling Anlagen Der Partner

Universal Querstromzerspaner UNI-CUT® SERIES QZ

Capabilities

Refrigerators

MACHINES PLANTS PROCESS SOLUTIONS

MeWa Recycling Anlagen Der Bauer

Universal Querstromzerspaner UNI-CUT® SERIES QZ

Capabilities

Personal computers and telecommunication equipment

MACHINES PLANTS PROCESS SOLUTIONS

MeWa Recycling Anlagen Der Bauer

Universal Querstromzerspaner UNI-CUT® SERIES QZ

Capabilities

Metal cleaning

MACHINES PLANTS PROCESS SOLUTIONS

Universal Querstromzerspaner UNI-CUT® SERIES QZ

Capabilities

Biomass

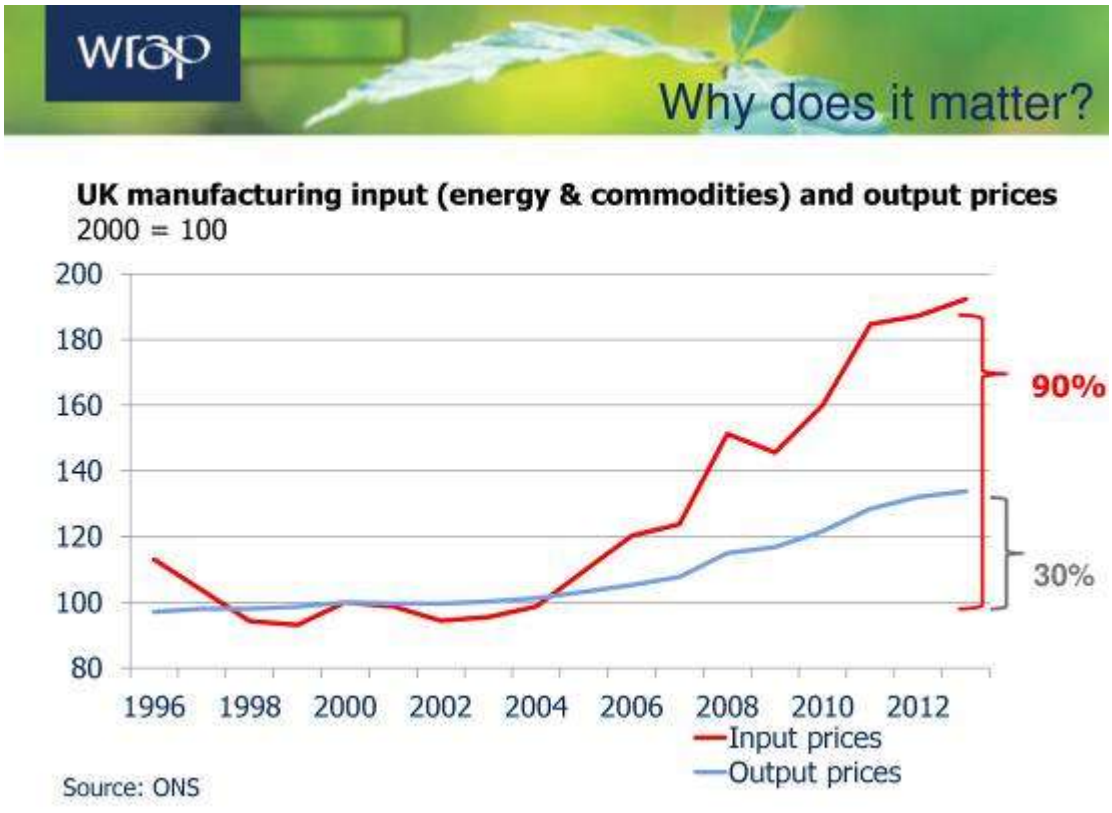
MACHINES PLANTS PROCESS SOLUTIONS

附件二 WRAP 簡報

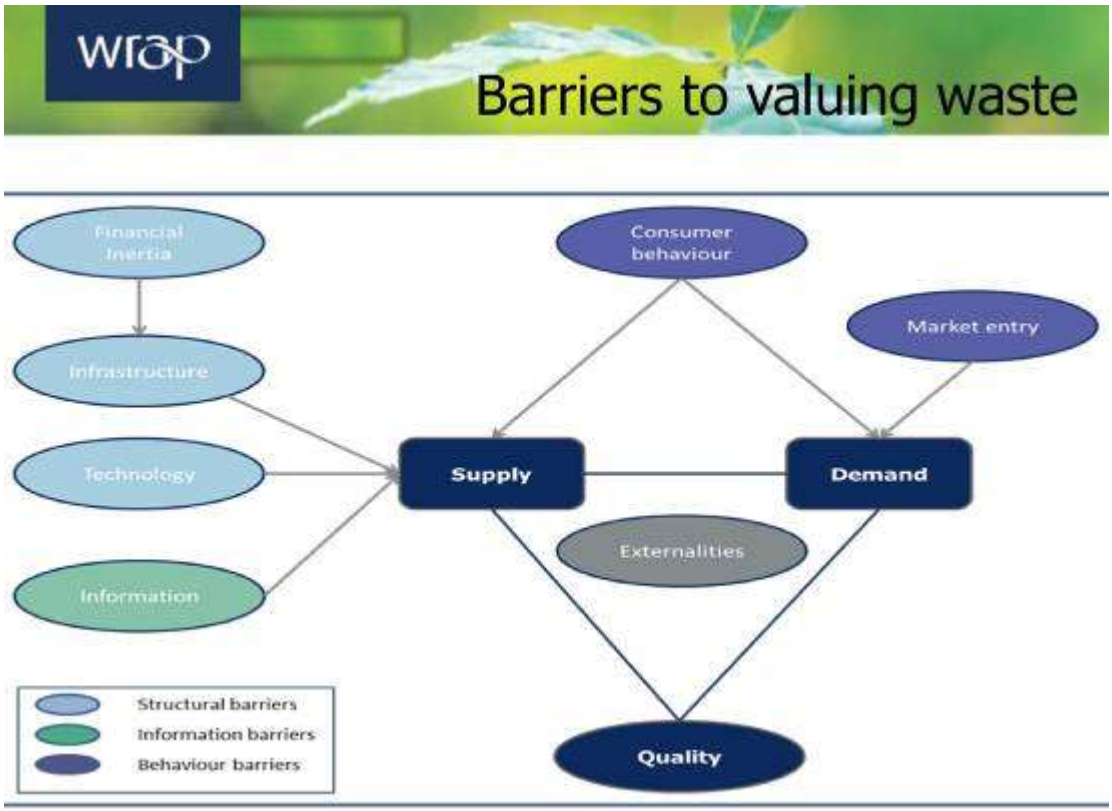
- Set up in 2000 to help recycling take off in the UK and to create a market for recycled materials
- Over the last decade, WRAP has helped and continue to help governments and businesses to devise strategies to deal with these issues
- RSAP published in 2012 to address unstable global metal and precious metal prices and improve resilience

Source: Defra, BIS, 2012


wrap
Why a circular economy?
Carbon
Water
Materials
Material extraction
Design & Production
Retail & Distribution
Use
Disposal
Resource Min
Waste Prevention
Recovery
Recycling
Re-use
Repair
Price stability
Supply chain resilience
Competitive-ness


wrap
Why does it matter?
UK manufacturing input (energy & commodities) and output prices
2000 = 100
200
180
160
140
120
100
80
1996
1998
2000
2002
2004
2006
2008
2010
2012
90%
30%
Input prices
Output prices
Source: ONS

- **Product Sustainability** – reinventing how we design, produce and sell
- **Behaviour Change** – rethinking how we buy, use and consume
- **Waste & Resource management** – redefining how we re-use and recycle



How to address the barriers

Collections

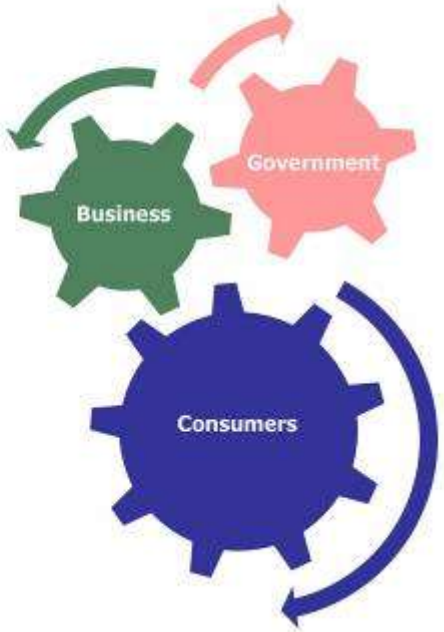
- Ensuring supply of quality material for recycling

Infrastructure

- Establishing the capacity to sort, recycle & reprocess
- Supporting recycling enterprises

Markets

- Building demand for & confidence in recycled materials



Market development

- Encouraging demand for recycled materials and products in existing markets
  - construction sector e.g. inerts
  - retail e.g. packaging
  - agriculture e.g. food waste
- Addressing barriers to market entry
- Encouraging new business and retail models
- Public sector procurement e.g. leadership

Behaviour change

- Raising awareness on recycling WEEE
- Providing content to 3rd parties
- Successful campaigns and events with Local authorities

See www.recyclenowpartners.org.uk for free WEEE collection support materials

Voluntary action

- Courtauld Commitment improving resource efficiency and reducing the carbon impact across UK grocery retail sector

1.2Mt
Packaging and Food Waste prevented

3.3Mt CO_2e saved | **$3bn** saved

10% less packaging impact

3.7% less household food and drink wasted

7.4% less waste in the supply chain

Packaging	• Reduce the carbon impact of grocery packaging by 10%
Household food waste	• Reduce household food and drink waste by 4% (tonnes)
Supply chain waste	• Reduce traditional grocery product waste in the grocery supply chain by 5% (tonnes)

- Hospitality & Food Service Agreement launched in June 2012

UK economic benefits

Thank you

Dr Mervyn Jones

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www.wrap.org.uk


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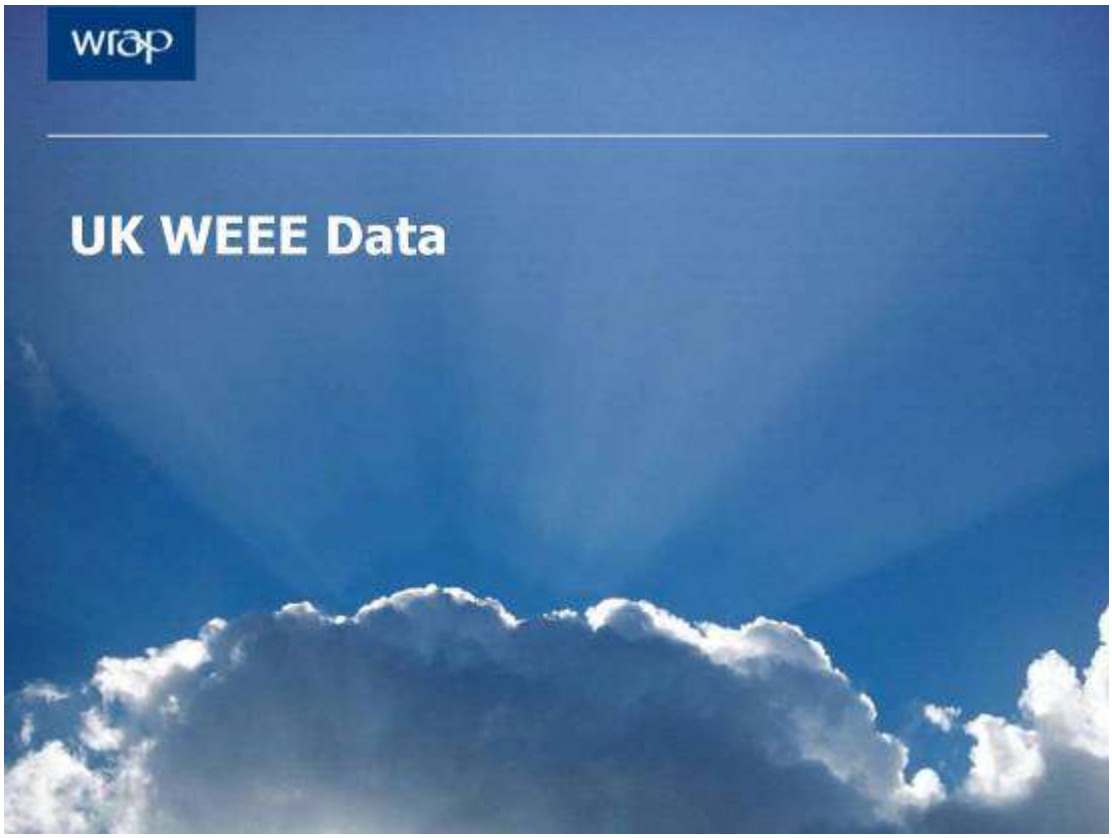
UK WEEE System Overview
Gerrard Fisher
WRAP
@WRAP_UK @gerrardfisher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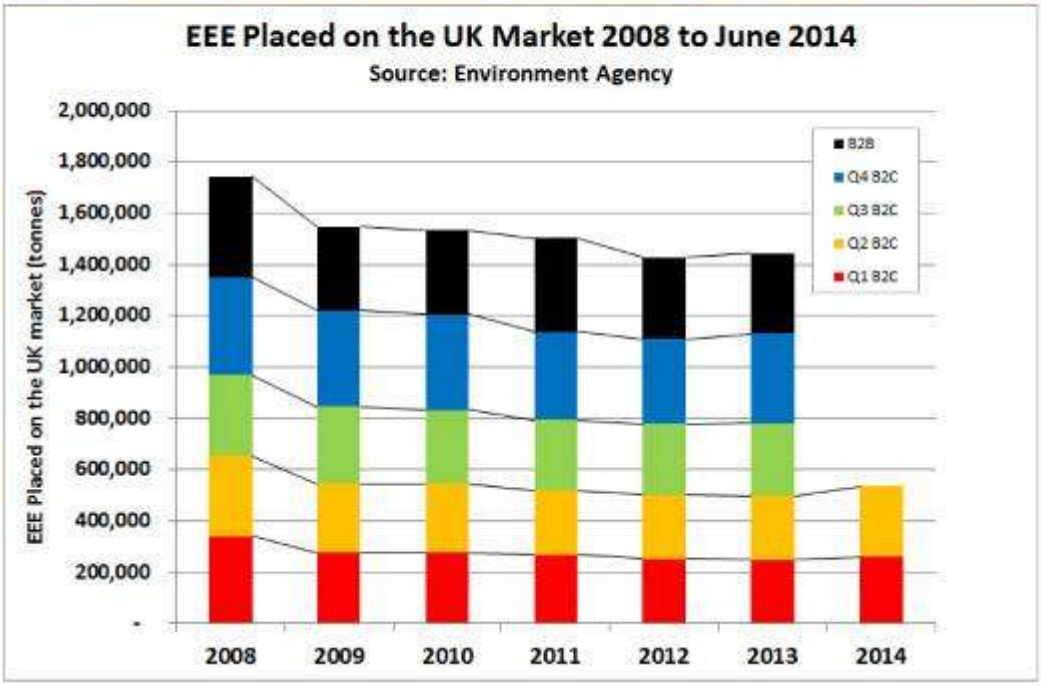
UK WEEE Data

UK EEE Sales



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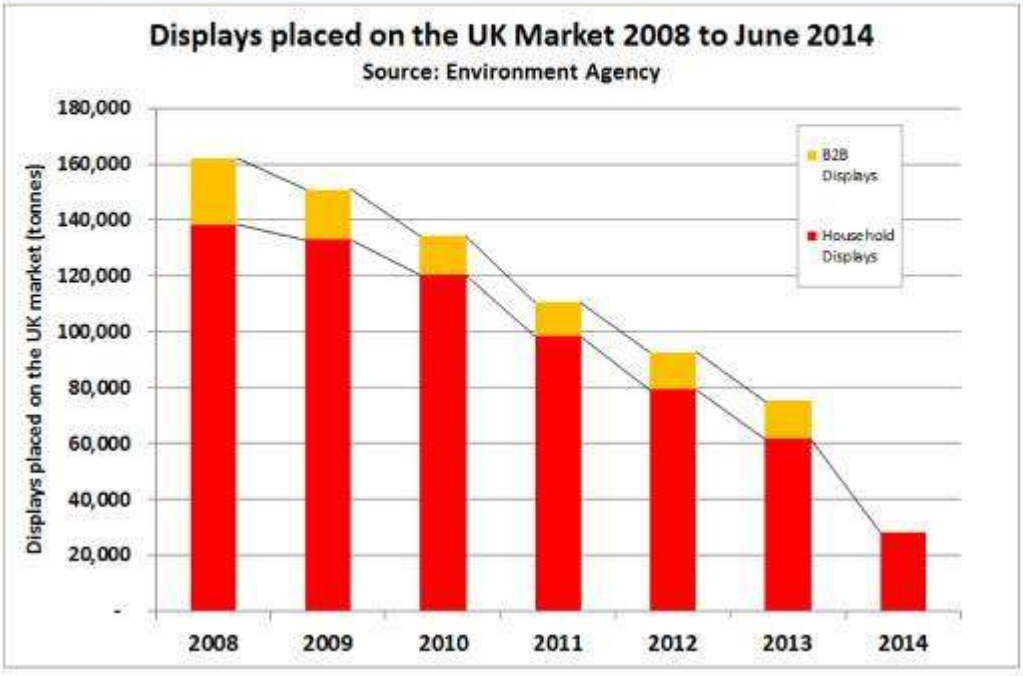
UK Display sales by weight (TVs and monitors)



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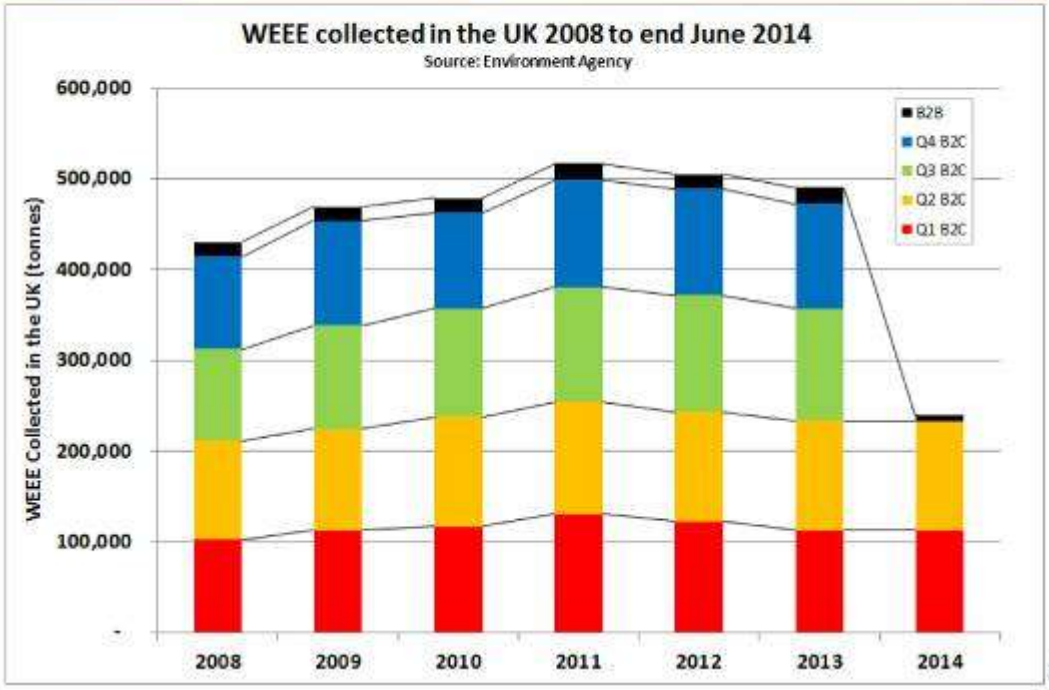
UK WEEE collections



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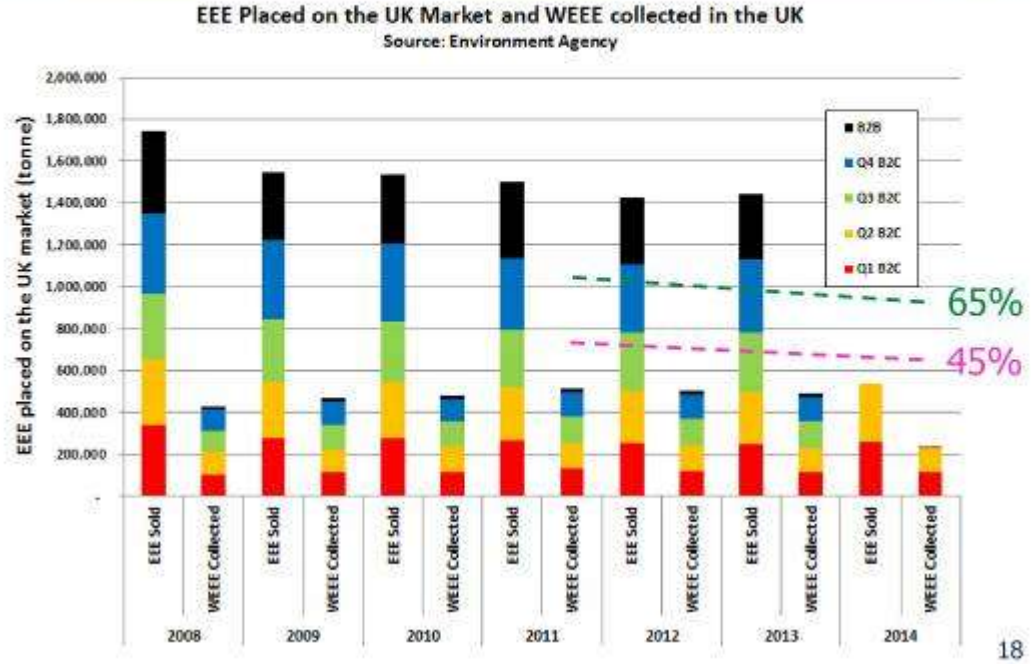
Comparing UK EEE & WEEE performance



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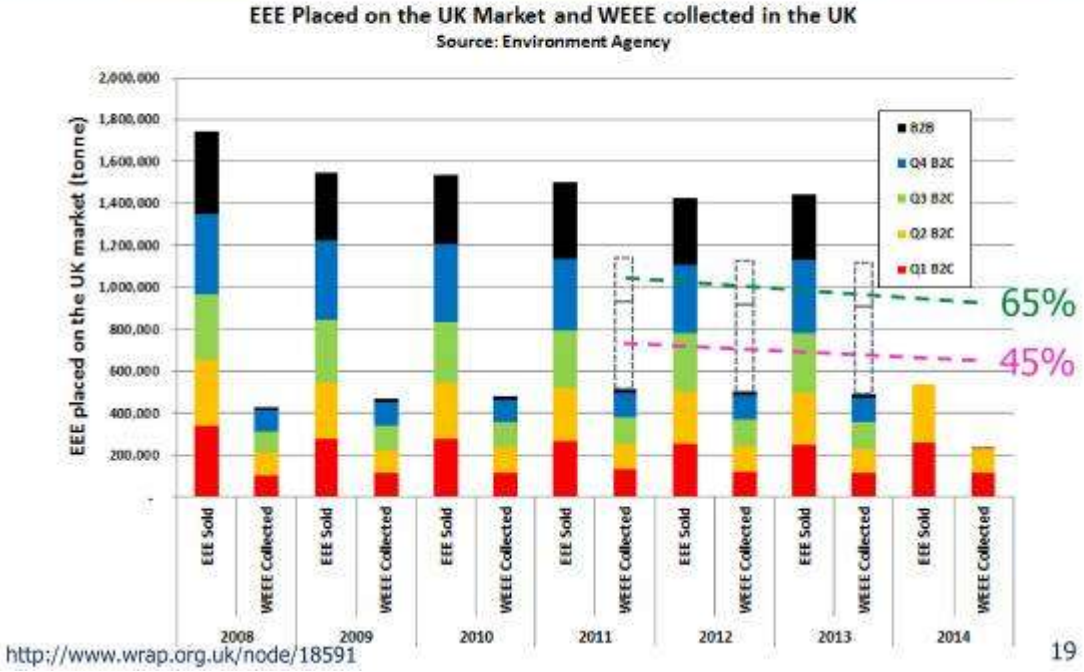
WRAP estimate of WEEE in "light iron" recycling system



http://www.wrap.org.uk/node/18591

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Main actors in the UK WEEE system

- **Producers**
- **Distributors**
- **Collectors**
- **Reusers**
  - Commercial
  - Social enterprises
- **Recyclers**
- **Producer Compliance Schemes (PCSs)**
  - Profit-making and not-for-profit

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Main categories of WEEE in the UK system

- Large Domestic Appliances (LDA)
- Small Domestic Appliances (SDA)
- Televisions and monitors (Displays)
- Fridges, freezers and air con units (Cooling appliances containing refrigerants)
- Fluorescent lighting (Gas discharge lamps)
- Coming soon – LED lamps and Solar PV panels

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Main issues in the UK WEEE system to date

- The flow of WEEE "evidence notes" from recyclers and between PCSs.
- Quality of collection varies widely:
  - range of ability to separate for reuse;
  - range of ability to collect separate categories.
- Quality of reuse and recycling varies widely.
- Classification of products as waste or for reuse (circular economy)

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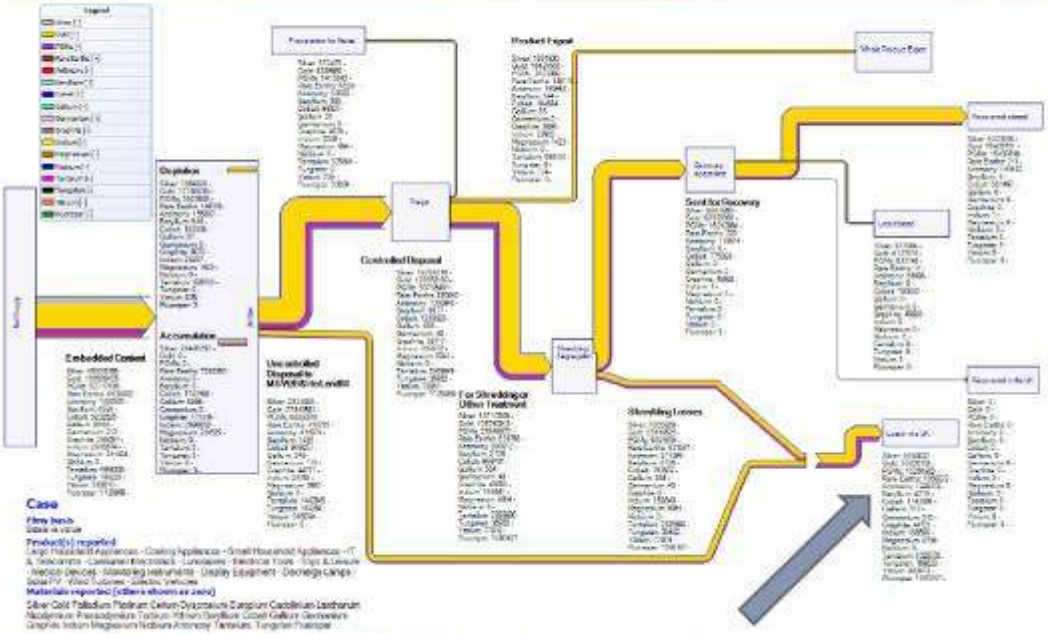
Lost value in the UK WEEE system: "critical" raw materials



Over £80m of material value lost in shredding

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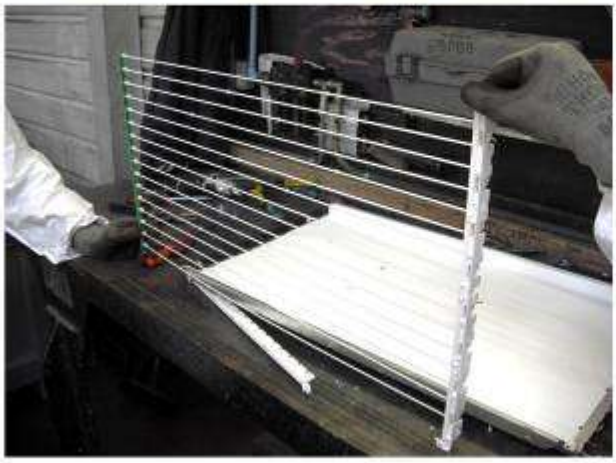
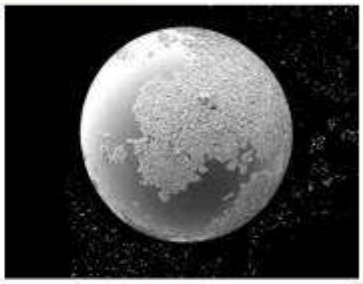
Anticipated future issues: whole system approach to ecodesign

Using mercury fluorescent backlights in LCD displays increases the hazard for collection and treatment operators.





DIGITALEUROPE

Mercury (Hg) Free logos

Hg

Hg

www.digitaleurope.org/Services/MecuryFreelogo.aspx

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Anticipated future issues: whole system approach to ecodesign

Customers may not hand in products for recycling to benefit the environment but they will be interested in options that protect their personal data.

Image with kind permission from http://draalin.com/

ADISA
ASSET DISPOSAL & INFORMATION SECURITY ALLIANCE

http://www.adisa.org.uk/

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Evidence for changes to how we buy and use EEE

80%
of UK householders surveyed wanted appliance guarantees to be 2 years or longer.

£400m product returns cost to UK businesses

23%
of products discarded at recycling centres still work or could be economically repaired

Proportion of products that do not meet average customer expectation for lifetime

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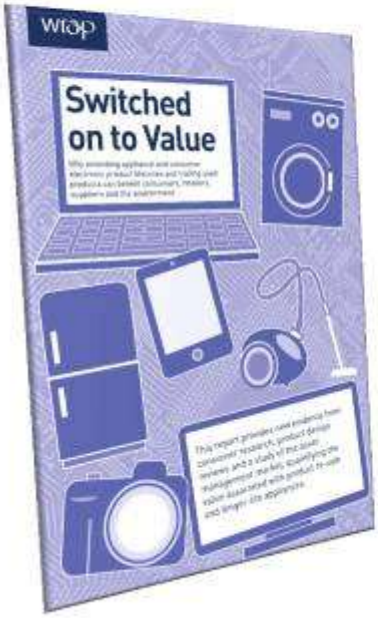
Trading & reusing consumer electronics



£3bn of electronic & electrical equipment in UK households that could be traded in.

2 out of 3 householders say they're willing to trade in products with the right retailer.

£800m GDP benefit to UK economy from developing trade-in models on TVs alone.

Returns value to customers, generates value for businesses, promotes reuse.

www.wrap.org.uk/content/switched-value

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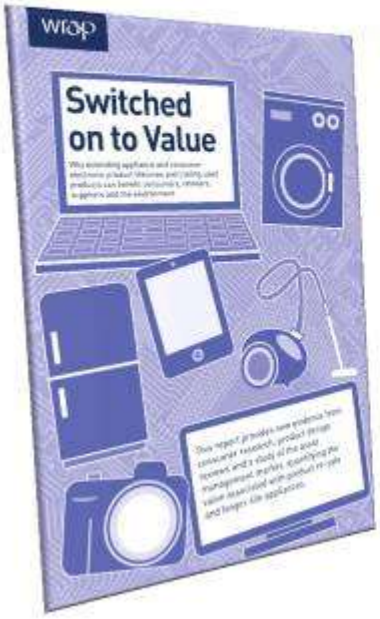
Switched on to value: appliances



80% of householders want longer guarantees included

Evidence of consumers shopping around for the best guarantee

Products that don't meet durability expectations:

www.wrap.org.uk/content/switched-value

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Why improve durability?
Return rates
Product returns cost UK retailers and brands up to £400 million every year
Better supplier relationships
Save time and resources by avoiding testing and negotiations with suppliers when products fail


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Why improve durability?
HOME CINEMA
Brand loyalty
Build customer loyalty through improved product reputation
Happy customer
80% of customers want guarantees of 2 years or longer on major appliances

Leading action across the product lifecycle

Extending product durability

Minimising product returns

Understanding and influencing consumer behaviour on product choice and repair

Implementing profitable, resilient and resource efficient business models

Gaining greater value from re-use, repair and recycling

Product durability and reliability (returns)

WRAP has created simple buying guidance for specifiers of own-brand electrical goods.

Addresses critical components known to affect reliability & durability.

Project contractors:

Anthesis, SKM ENVIROS, e3, Which?, Intertek, ERA TECHNOLOGY

www.wrap.org.uk/betterappliances

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With the contribution of the LIFE financial instrument of the European Community

The REBus Project

www.rebus.eu.com

Goal: Profitable, resource efficient and resilient

- Expert guidance
- Reduces risk of changing model
- Presents bespoke commercial case
- Evaluate pilots, case studies
- Publish 'how to' toolkit

In numbers:

30 pilots

3.5 years

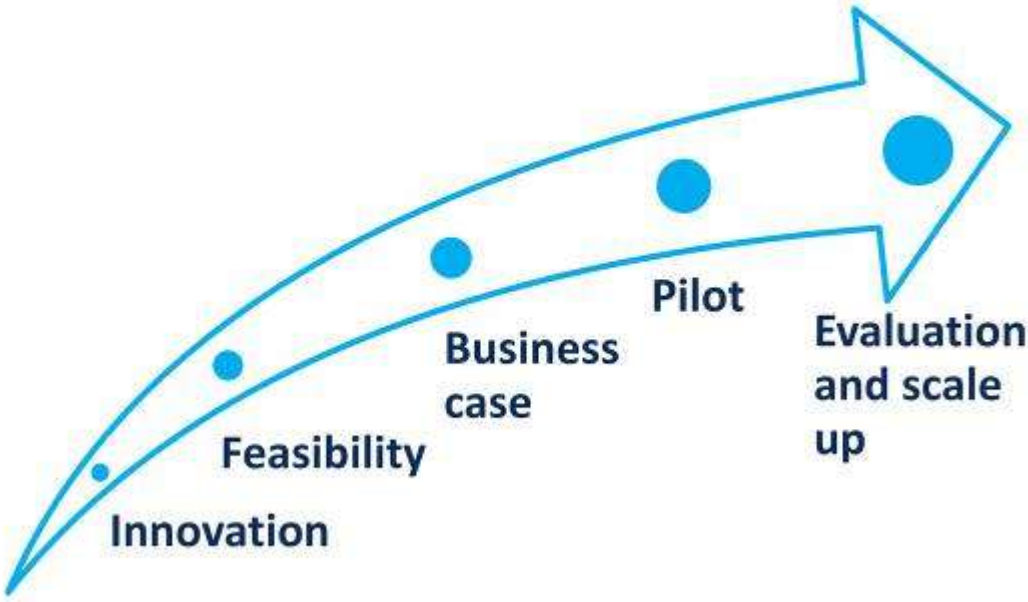
€3.1m

Rijkswaterstaat
Ministry of Infrastructure and the Environment

THE UNIVERSITY OF NORTHAMPTON
School of Science and Technology

ALDERSGATE GROUP

Our stage gate support towards circular business



With the contribution of the LIFE financial instrument of the European Community

www.rebus.eu.com

Partners already involved

Projects are progressing to trial and scale-up stages now.

With the contribution of the LIFE financial instrument of the European Community

www.rebus.eu.com

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Thank you

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